



EQUALITY/BALANCE

Session 5

Topic	Activity Name	Page Number	Related SOL	Activity Sheets	Materials
Equivalence	How Many Baby Bears	189	K.17, 1.20		Balance scale, Teddy Bear counters, or other manipulatives
	Missing Addends	190	2.26, 3.4		Counters, linking cubes, two-pan balance scales
	Seesaw Balance	192	2.26, 3.4, 5.21	Seesaw Balance Activity Sheets	Overhead projector
Solving Equations	Can You Make The Scale Balance	197	3.25, 4.22, 5.21		Cubes or Counters, balance scale worksheet, overhead projector, transparency of Balance Scale
	Weighty Problems	199	2.26, 4.22, 5.21	Weighty Problems Activity Sheets	Stationary physical scale, geometric solids
	Balance Those Blocks	226	2.26, 4.22, 5.21		Laminated balance scale, stationary physical scale, unit blocks, rectangular solids
	Coat Hanger Balances	228	2.9, 5.21	Shape Pattern Activity Sheets	One coat hanger per participant, yarn or string, tape, scissors



Activity: How Many Baby Bears?

Format: Whole Group

Objectives: Kindergarten and first graders will begin to formalize emerging algebraic thinking as they study the relationships between and among quantities. A balance scale will reinforce two-for-one equivalence as students weigh Mama Bear and Baby Bear counters.

Related SOL: K.17, 1.20

Materials: Balance scale for each pair of participants, Teddy Bear counters (the three size set), or other manipulatives where the weight relationship is 1-2-4 (1 papa = 2 mamas = 4 babies)

Time Required: 10 minutes

Directions:

4. Ask participants to select a set of Mama Bear and Baby Bear counters and place them on their table.
5. Instruct participants to place the Mama Bear on the balance scale and discover that the scale does not balance but, instead, tips.
6. Ask participants to place a Baby Bear on the other pan of the balance to discover that the scale still does not balance.
7. Next, ask participants to place another Baby Bear counter in the same pan as the original Baby Bear and discover what happens.
8. Ask participants to decide upon a rule that they discover about the balance, such as, "The number of Baby Bears is twice the number of Mama Bears."
9. Question the students as to this occurrence:
 - What do you think would happen if you put another Mama Bear on the pan?
 - What would you need to do to balance two Mama Bears?
 - What would you need to balance three Mama Bears?
 - What would you need to balance four Baby Bears?
10. Ask participants to think of a way they can record what they discovered to share with the class.
11. Be prepared to guide participants to write: One to two, two to four, three to six; or $m = 2b$ (one Mama Bear is equivalent to two Baby Bears).

Patterns, Functions, and Algebra



Activity: Missing Addends

Format: Small Group

Objective: Participants will be able to move from a concrete understanding of missing addends to conceptual understandings of the simplest of equations through investigations with two-pan balances.

Related SOL: 2.26, 3.4

Materials: Teddy Bear Counters or other appropriate counters, linking cubes, two-pan balance scales

Time Required: 10 Minutes

Directions:

1. Explain to the children that two blue bears and three red bears have decided to go on a camping trip.



2. Direct the children to use their counters to model exactly what this looks like.
3. Invite the participants to tell you the addition equation you would write to explain exactly what is happening with the Teddy Bears and the camping trip.
4. Repeat this same procedure with several other equations.
5. Explain to the participants that some of the bears wondered off the path on the camping trip and erase one addend in each equation
6. Ask the participants to assist you in discovering exactly how many bears might be lost on the camping trip.
7. Once you are sure that the participants are comfortable with the concrete manipulation of the counters, assist them in transferring that understanding to the two-pan balance scale.

Patterns, Functions, and Algebra

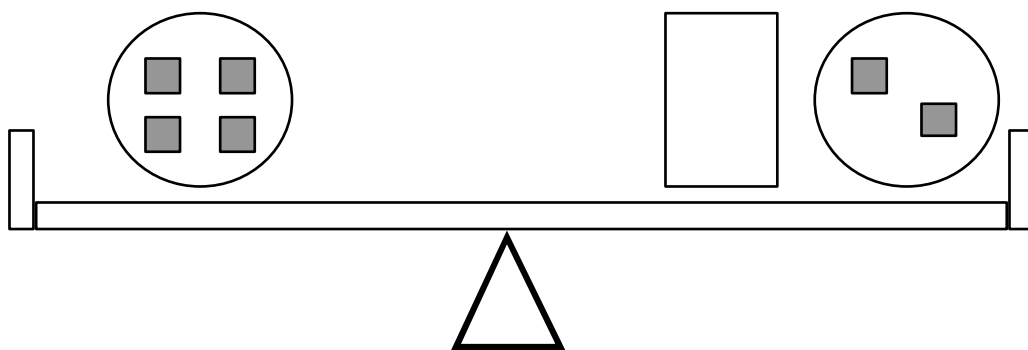


8. Say:

Now boys and girls, we are going to work with the two-pan balance scales to discover more about missing addends. This time instead of using Teddy Bears to discover about missing addends, we are going to use linking cubes.

When you put one linking cube in one pan, what happens to the balance? If you put one cube in the other pan, what will happen? If each pan on the balance has five cubes, what will happen if two cubes are added to each pan? What will happen if five cubes are added to the left pan and only one is added to the right pan? What will happen if three cubes are removed from each pan? What will happen if four cubes are removed from the right pan?

9. Assist participants in transferring the learning by directing them to work with a partner to complete numerical representations of missing addends on balance scales.



$$4 = \underline{\quad} + 2$$

$$4 = \underline{\quad ? \quad} + 2$$

$$4 = \underline{\quad x \quad} + 2$$

Presenter's Notes:

Patterns, Functions, and Algebra



Activity: Seesaw Balances

Format: Small Group

Objective: Participants will be able to balance a scale by assigning numerical values to characters on a balance scale and by adhering to prescribed rules.

Related SOL: 2.26, 3.4, 5.21

Materials: Overhead projector, Seesaw Balance Activity Sheets

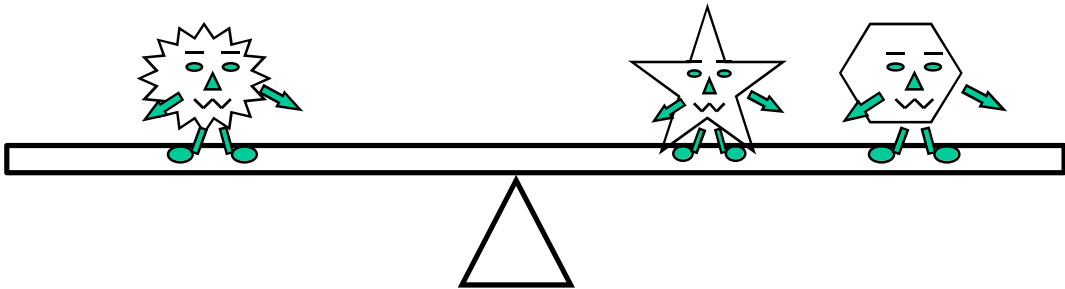
Time Required: 15 Minutes


Directions:

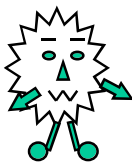
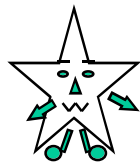
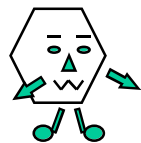
1. Display the overhead transparency of a seesaw balance on the overhead projector.
2. Explain to participants that they will be assigned weights for some of the characters represented on the seesaw.
3. Instruct the participants that they are to calculate a numeric value for each of the characters.
4. Remind participants to follow all the rules:
 - *Balance the seesaw.
 - *Gobots that are the same have the same weight.
 - *Gobots that are different have different weights.
 - *All gobots weigh more than zero pounds.
5. Encourage participants to work with a partner to discover as many solutions as possible for each problem.




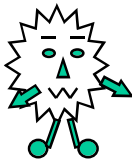

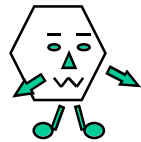
SEESAW BALANCES



If  on the seesaw weighs four pounds, what could the other gobots weigh?

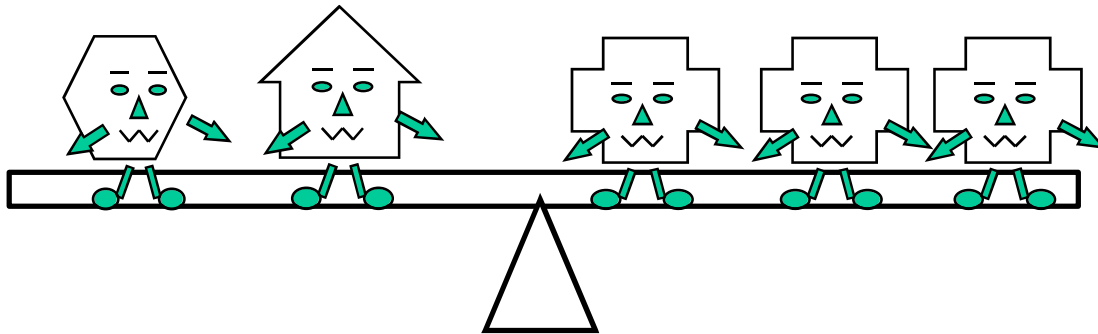
		
4	1	3
4	3	


If  on the seesaw weighs seven pounds, what could the other gobots weigh?

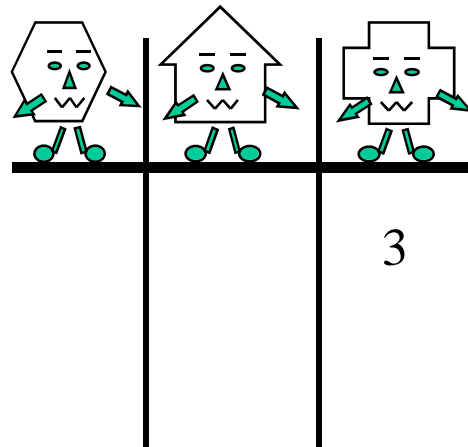
		




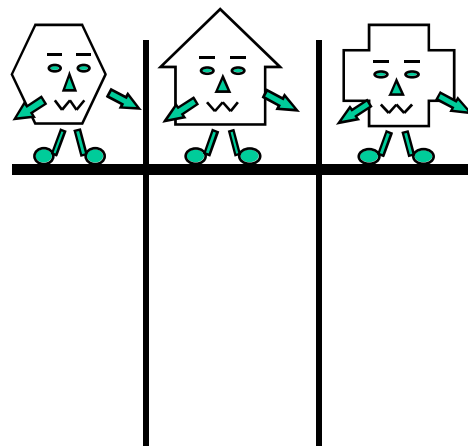
SEESAW BALANCES



If  on the seesaw weighs three pounds, what could the other gobots weigh?

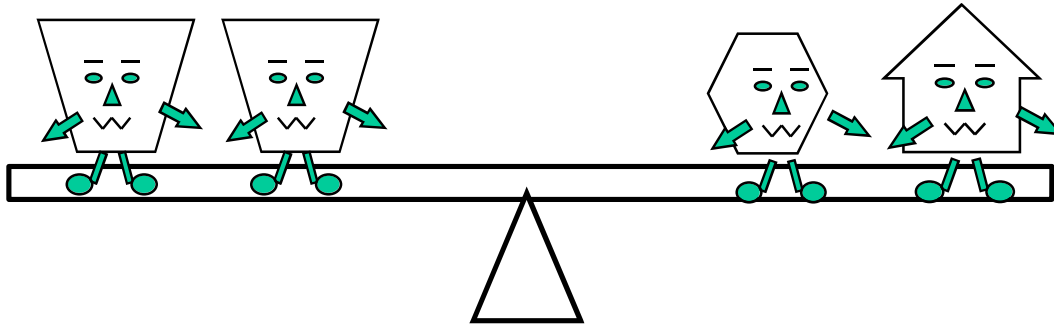



If  on the seesaw weighs four pounds, what could the other gobots weigh?

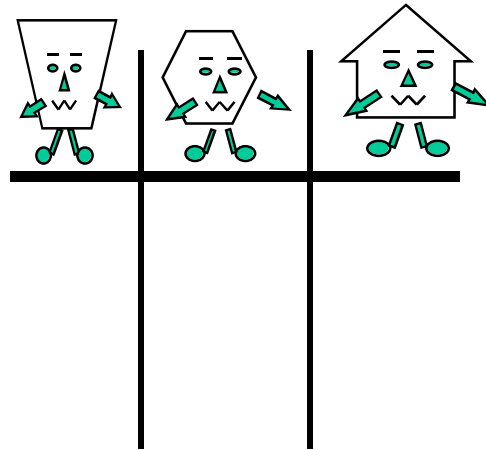





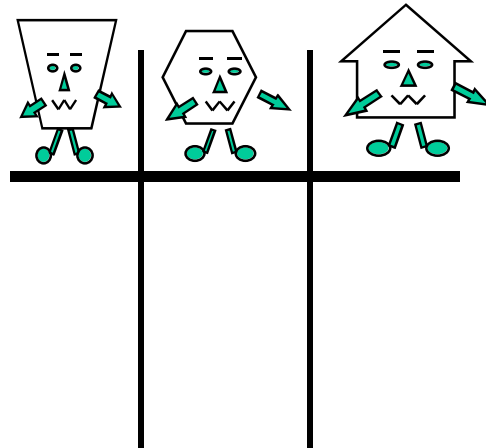
SEESAW BALANCES



If  on the seesaw weighs three pounds, what could the other gobots weigh?

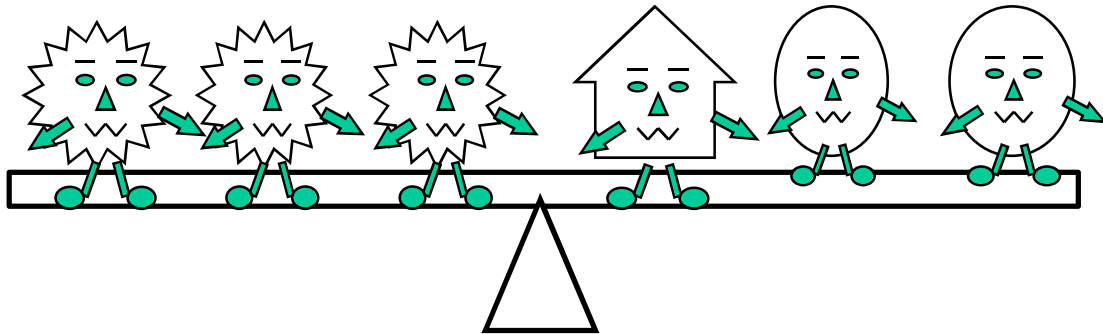



If  on the seesaw weighs five pounds, what could the other gobots weigh?

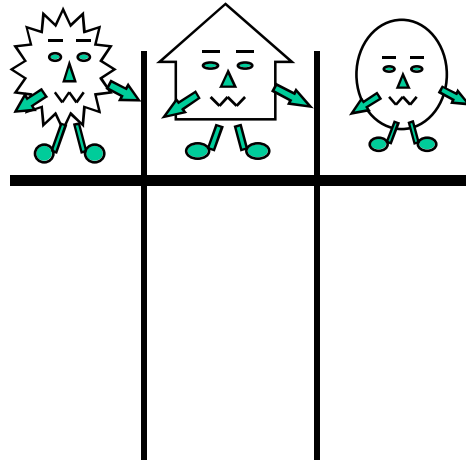





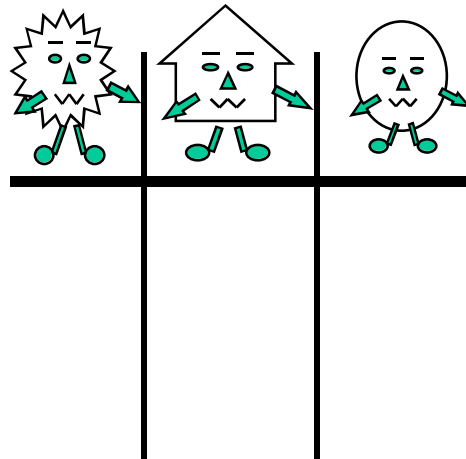
SEESAW BALANCES



If  on the seesaw weighs five pounds, what could the other gobots weigh?



If  on the seesaw weighs six pounds, what could the other gobots weigh?



Patterns, Functions, and Algebra



Activity: Can You Make This Scale Balance?

Format: Small Group

Objective: Participants will be able to balance the scale with a variety of different combinations of cubes by placing the colored cubes on provided shapes.

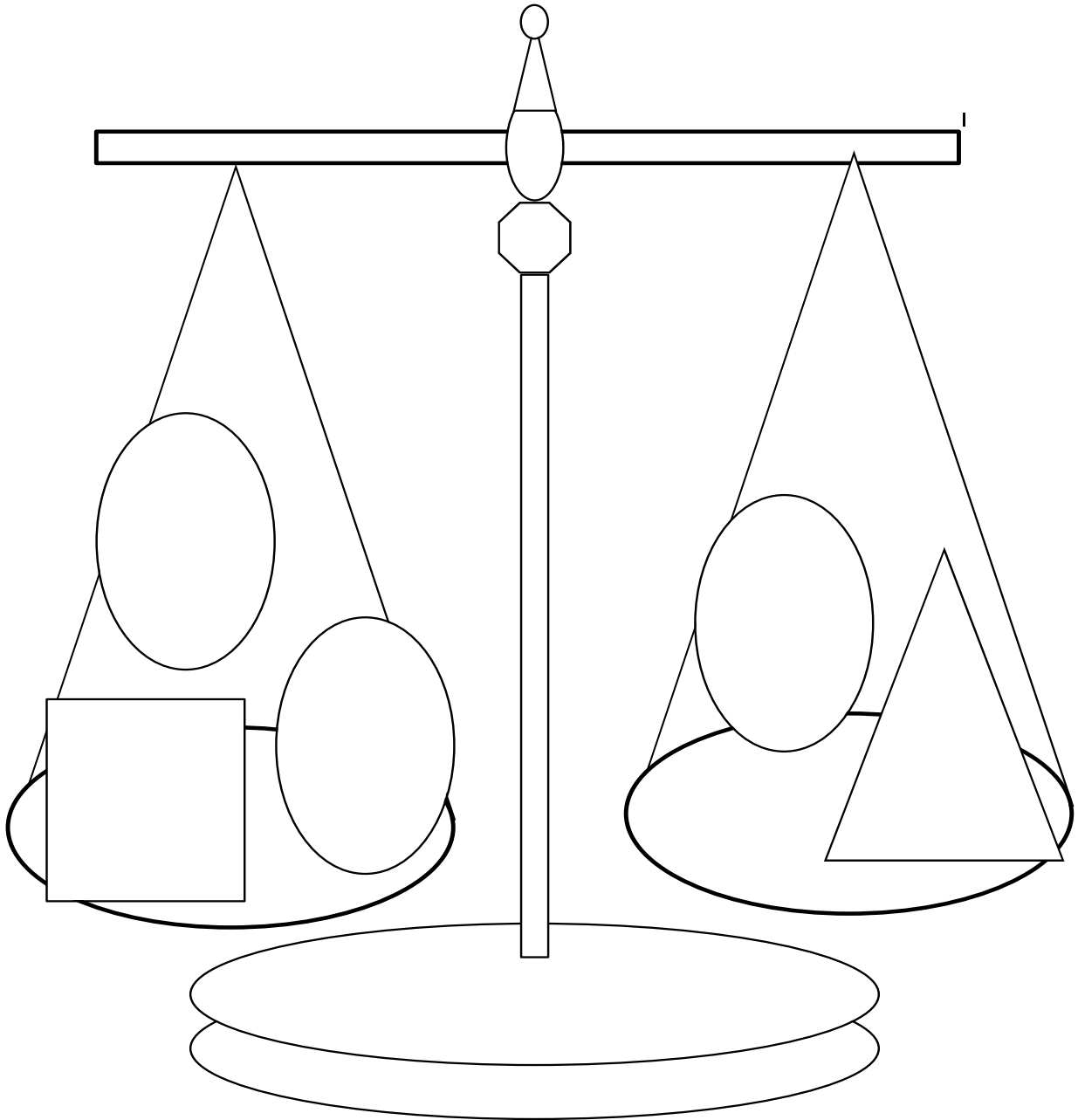
Related SOL: 3.25, 4.22, 5.21

Materials: Colored cubes or counters, balance scale worksheet for each student, overhead projector, transparency of the Balance Scale

Time Required: 20 minutes

Directions:

1. Display the Balance Scale transparency on the overhead projector.
2. Explain to participants that they can balance the scale by placing colored cubes in the square, circle, and triangle shapes on the scale
3. Instruct participants that they must follow the rules that you will list on the board or on chart paper.
 - Shapes that are the same must hold the same numbers of cubes.
 - Shapes that are different must hold different numbers of cubes.
 - All shapes must hold some cubes.
 - The two sides must balance by holding equal numbers of cubes all together.
 - You may use a total of 10, 15, or 20 cubes.
4. Assign each participant a partner and ask them to balance their Balance Scale using eighteen rainbow cubes.
5. Be sure to remind the participants to follow all the rules.
6. Work on the chalkboard or overhead to create a table that will track participants' differing solutions.
7. Instruct participants to again attempt to balance the scale this time using ten, fifteen, and finally twenty colored cubes.
8. Encourage participants to record their findings so that they will be able to explain how they balanced the scale each time.



Same Shapes Must Hold Same Numbers

Patterns, Functions, and Algebra



Activity: Weighty Problems

Format: Small Group

Objective: Participants will explore the concepts of equality among variable expressions to develop an understanding of equality or balance. This is a necessary foundation for solving equations in algebra.

Related SOL: 2.26, 4.22, 5.21

Materials: Weighty Problems Activity Sheets: Primary and Upper Elementary , stationary physical scale, geometric solids

Time Required: 50 Minutes

Directions:

1. Present the weighty problems to the participants as transparencies on an overhead projector. (Teachers can use these problems with participants and may wish to reproduce them as handouts or as laminated problem cards.) Recognize that concrete experiences with a balance scale can provide the foundation for understanding the concepts of equality and inequality.
2. Discuss the concepts that participants would be required to develop, including weight relationships, equality, and equivalent expressions.

Weighty Problem Cards

Primary Set #1- #11:

Objective: Deduce weight relationships
Recognize that a balanced scale represents equality

Teacher Questions Appropriate to the Different Situation Might Include :

- What does the scale show? or What does the first (or second) scale show?
 - How are the scales alike? How are they different?
 - Which scale would you use first to solve the problem? Why?
 - How can you find the weight of the geometric solid (sphere, cylinder, cone)?
3. Have the participants develop a few cards of their own. Suggest that they use common objects such as pictures of toys like dolls, trucks, shoes, etc.

Patterns, Functions, and Algebra



Weighty Problem Cards

Upper Elementary Set #1- #10:

Objective: Deduce relationships among the mass of objects from visual cues.
Recognize that a balanced scale represents equality
Identify collections of objects with equal mass.
Recognize that there are a variety of ways to solve each problem.

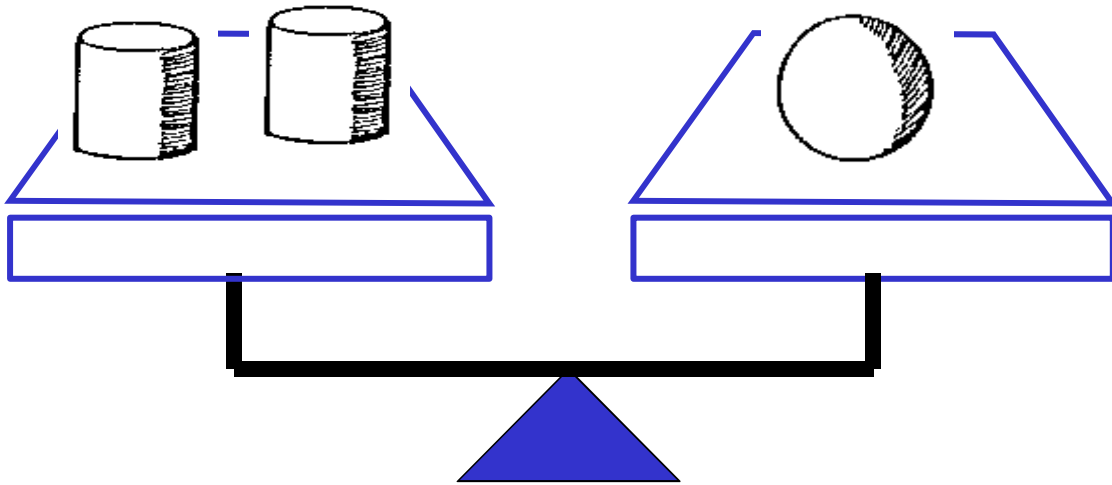
Teacher Questions Appropriate to the Different Situation Might Include :

- What do the scales show? or What does scale A (or B) show?
 - How are the scales alike? How are they different?
 - Do any scales have only one type of object on them? What can you deduce about the weight of each object on a scale like this?
 - Do any scales differ by only one object? What does this tell you about the scale?
 - What object weighs more? What object weighs the least?
 - Which scale would you use first to solve the problem? Why?
 - How can you find the weight of the geometric solid (sphere, cylinder, cone)?
4. Have the participants develop a few cards of their own using the blank. Suggest that they use common objects such as action figures, cars, beads, etc.



Weighty Problems

Primary #1



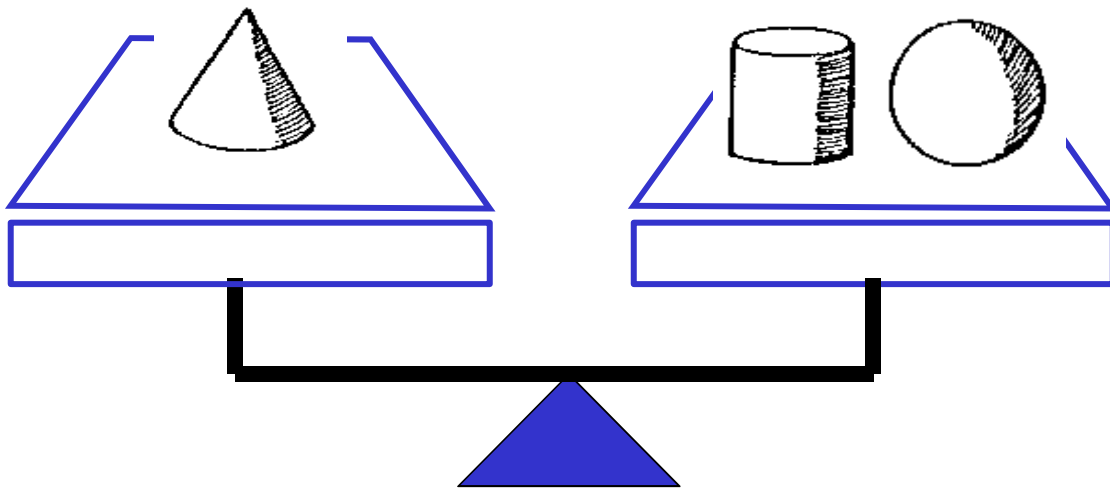
Circle the block that weighs more.



Explain how you know. _____



Weighty Problems Primary #2



Circle the block that weighs more.

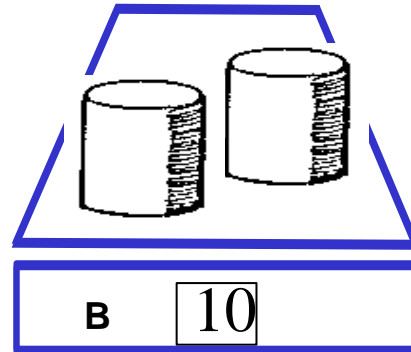
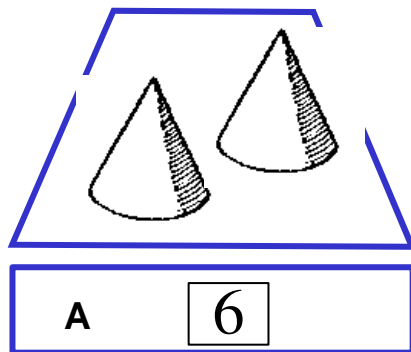



Explain how you know. _____




Weighty Problems

Primary #3



1.  weighs _____ pounds.

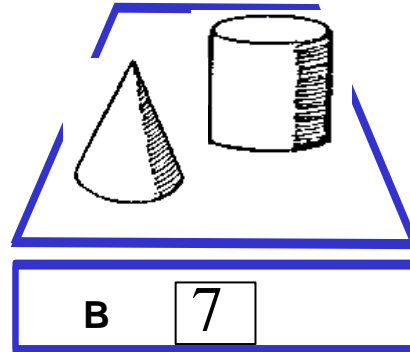
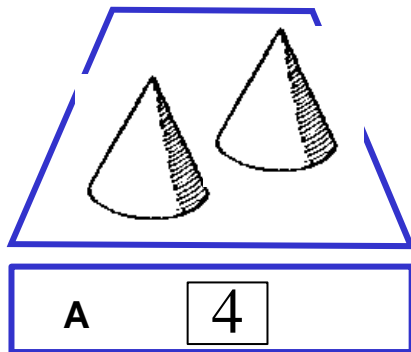
2.  weighs _____ pounds.

3.  and  weigh _____ pounds.





Weighty Problems

Primary #4



1.  weighs _____ pounds.

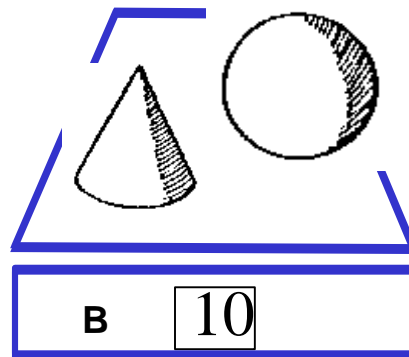
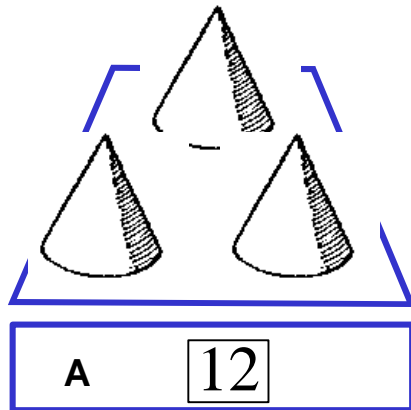
2.  weighs _____ pounds.

3. How did you find the weight of  ? _____




Weighty Problems

Primary #5



1.  weighs _____ pounds.

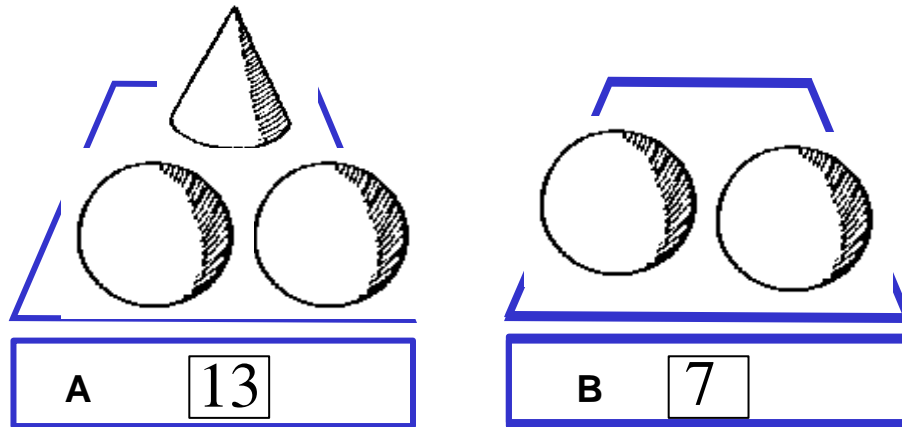
2.  weighs _____ pounds.

3. How did you find the weight of  ? _____




Weighty Problems

Primary #6



1.  weighs _____ pounds.

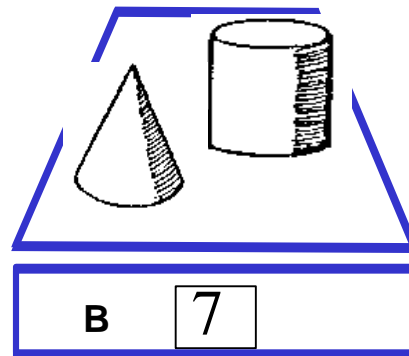
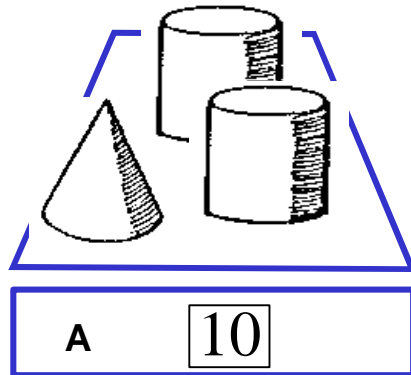
2.  weighs _____ pounds.

3. How did you find the weight of  ? _____



Weighty Problems

Primary #7



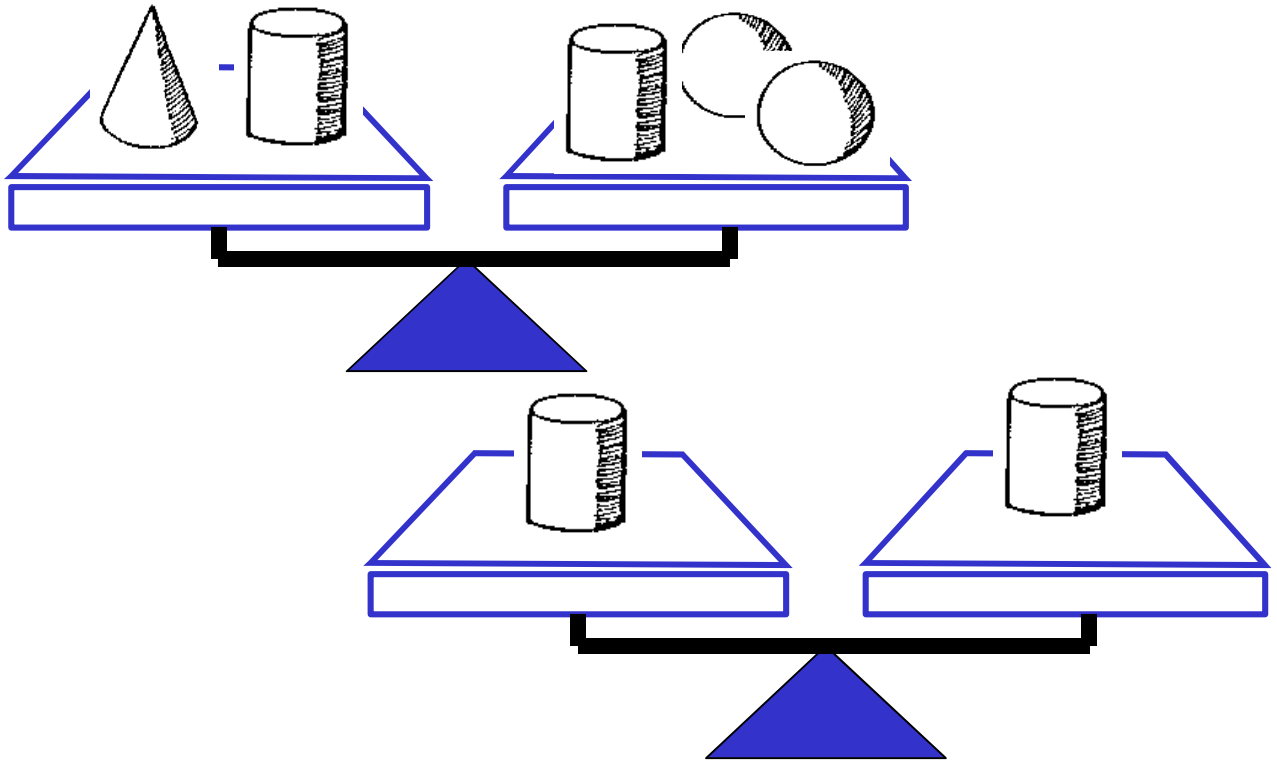
1.  weighs _____ pounds.

2.  weighs _____ pounds.

3. How did you find the weight of  ? _____



Weighty Problems Primary #8



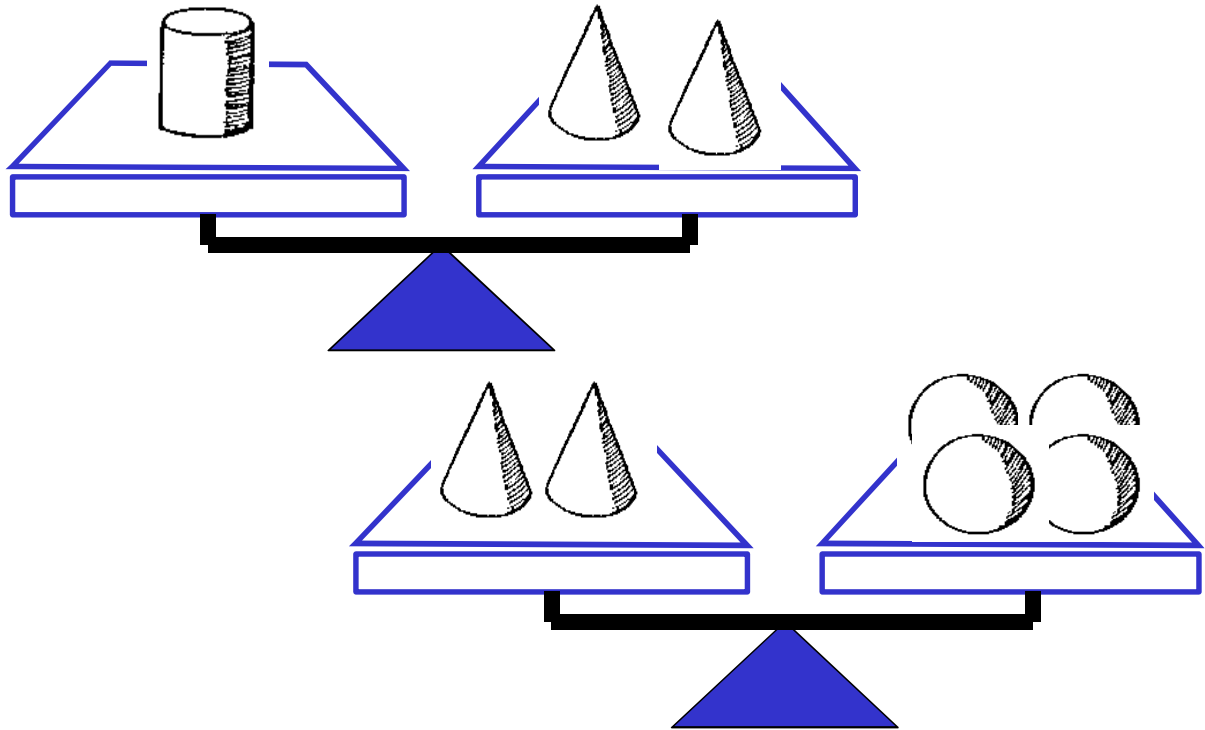
Circle the block that weighs more.



Explain how you know. _____



Weighty Problems Primary #9



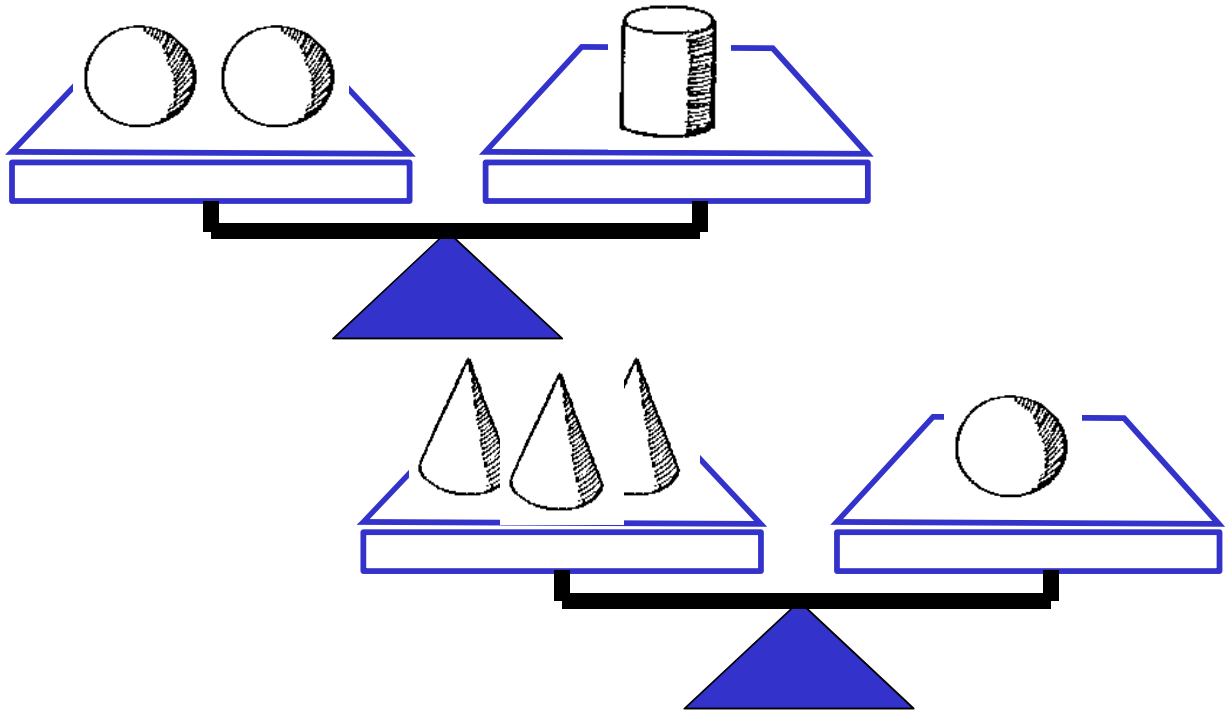
Circle the block that weighs the most.
Put a check mark on the one that weighs the least.



Explain how you know. _____

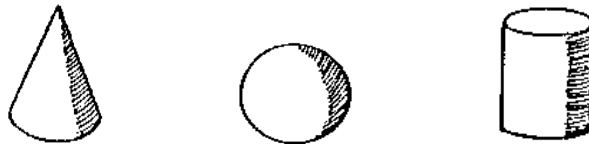


Weighty Problems Primary #10



Circle the block that weighs the most.

Put a check mark on the one that weighs the least.

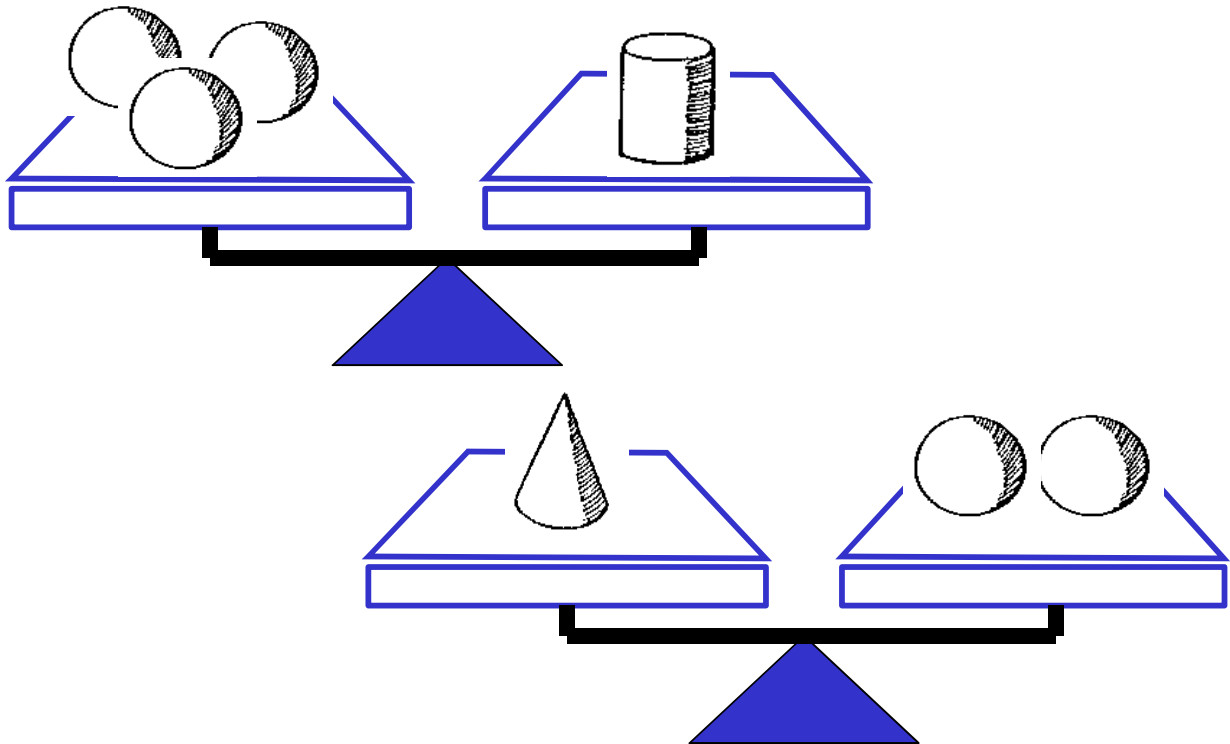


Explain how you know. _____



Weighty Problems

Primary #11



Circle the block that weighs the most.

Put a check mark on the one that weighs the least.

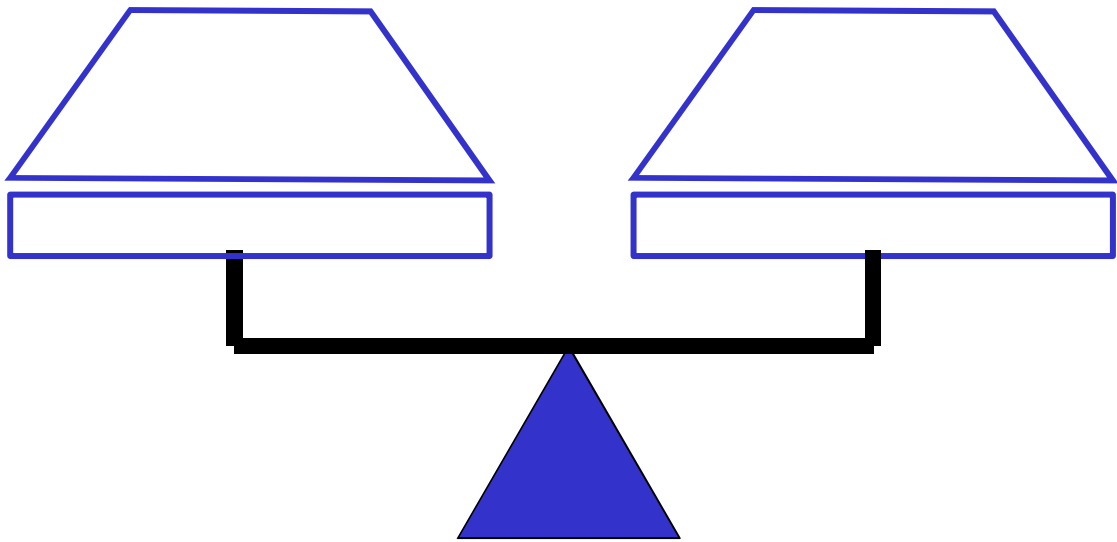


Explain how you know. _____



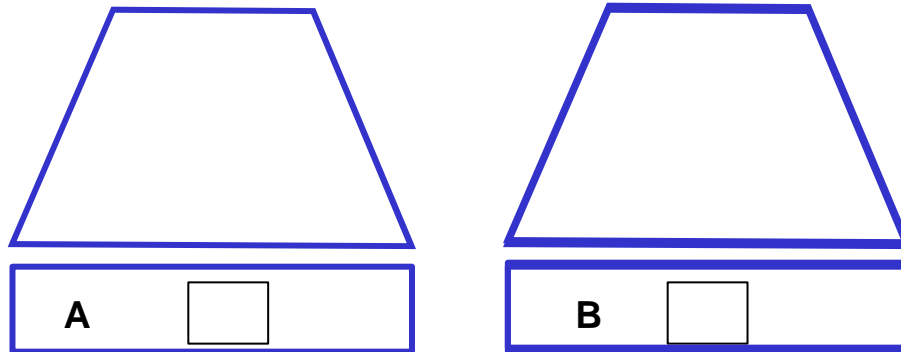
Weighty Problems

Primary





Weighty Problems: Primary

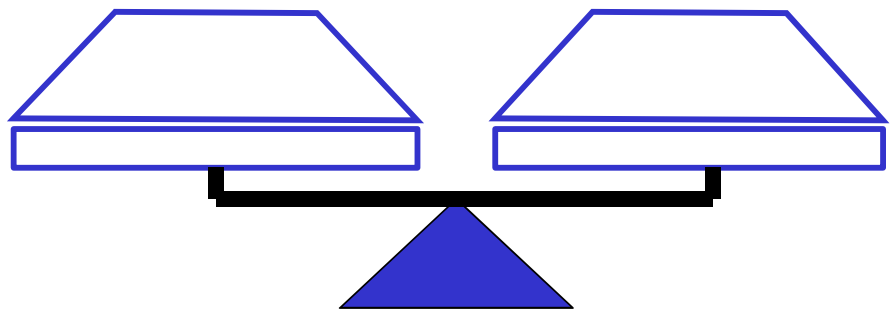
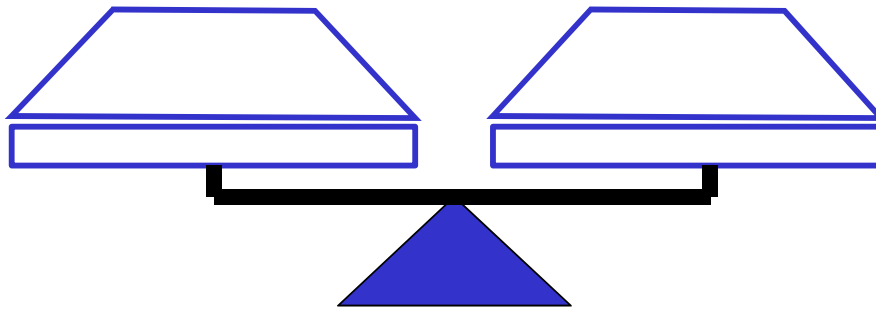


1. weighs _____ pounds.

2. weighs _____ pounds.



Weighty Problems: Primary

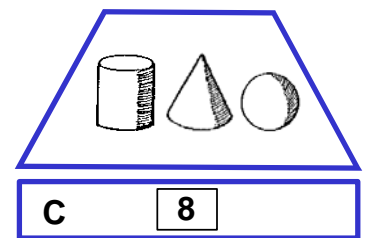
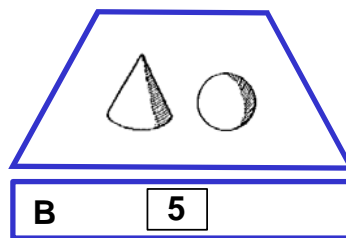
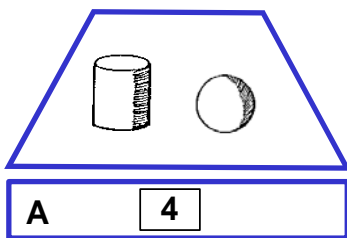


Circle the one that weighs the most.
Put a check mark on the one that weighs the least.

Explain how you know. _____



Weighty Problems #1



1. Find the weight of each block.

cylinder = _____ pounds

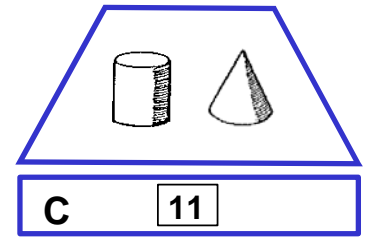
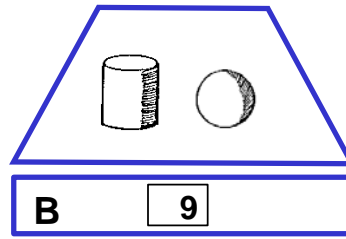
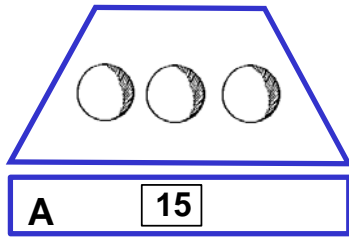
sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.



Weighty Problems #2



1. Find the weight of each block.

cylinder = _____ pounds

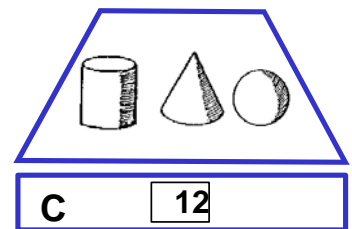
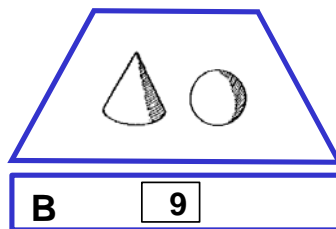
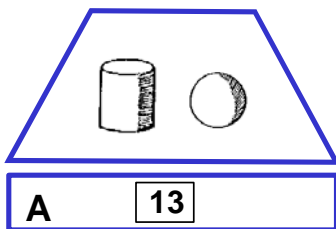
sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.



Weighty Problems #3



1. Find the weight of each block.

cylinder = _____ pounds

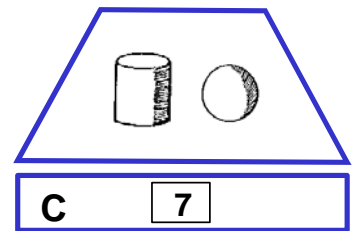
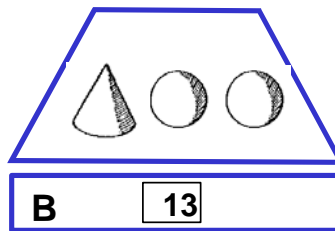
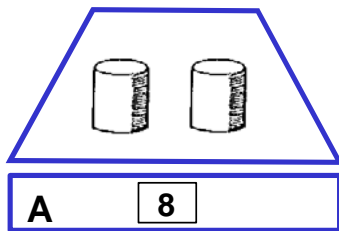
sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.



Weighty Problems #4



1. Find the weight of each block.

cylinder = _____ pounds

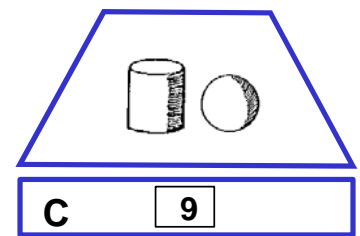
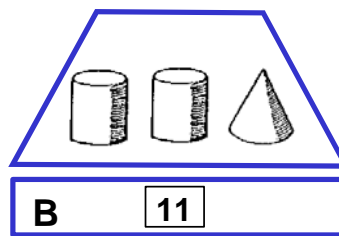
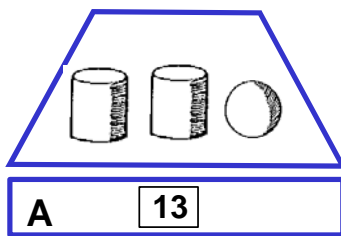
sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.



Weighty Problems #5



1. Find the weight of each block.

cylinder = _____ pounds

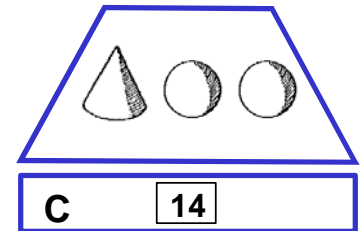
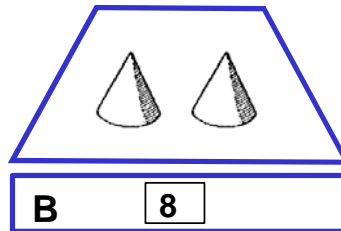
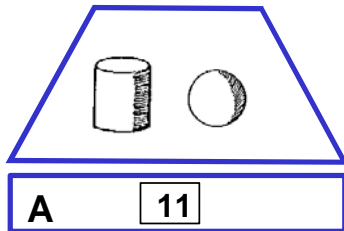
sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.



Weighty Problems #6



1. Find the weight of each block.

cylinder = _____ pounds

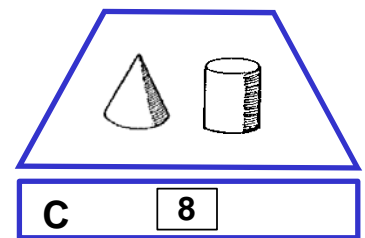
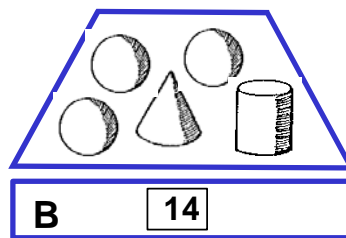
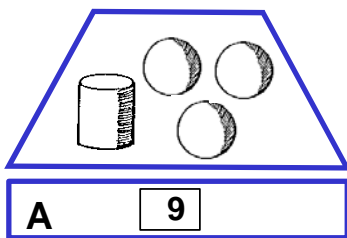
sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.



Weighty Problems #7



1. Find the weight of each block.

cylinder = _____ pounds

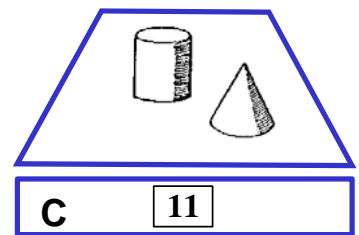
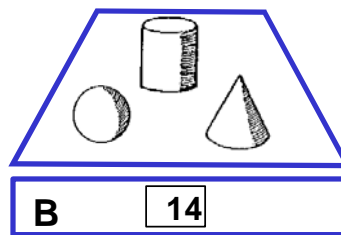
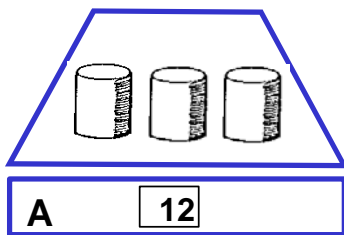
sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.



Weighty Problems #8



1. Find the weight of each block.

cylinder = _____ pounds

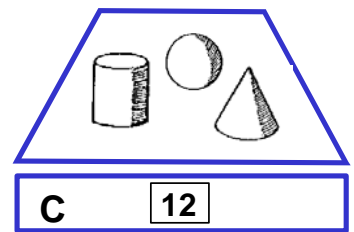
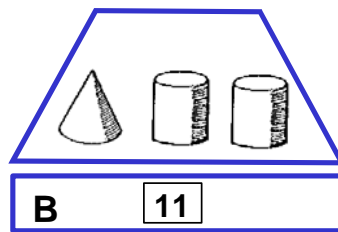
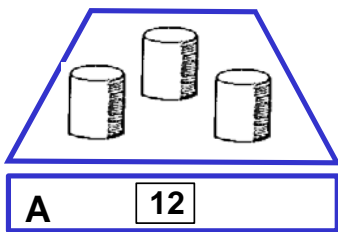
sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.



Weighty Problems #9



1. Find the weight of each block.

cylinder = _____ pounds

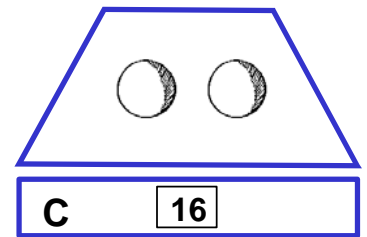
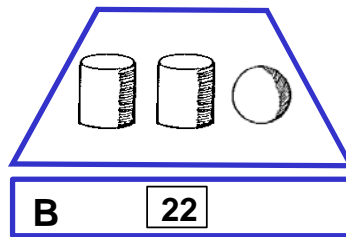
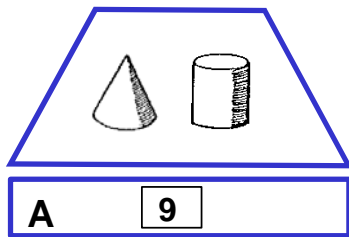
sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.



Weighty Problems #10



1. Find the weight of each block.

cylinder = _____ pounds

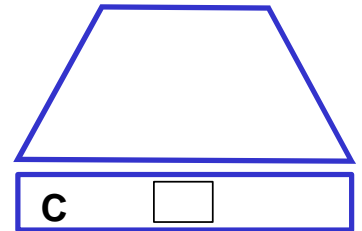
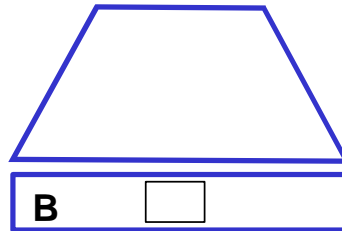
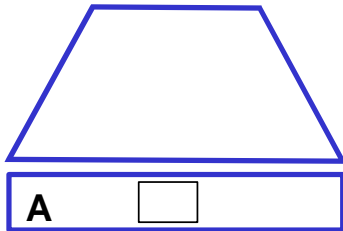
sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.



Weighty Problem



1. Find the weight of each block.

cylinder = _____ pounds

sphere = _____ pounds

cone = _____ pounds

2. List or draw the steps you followed to solve the problem.

Patterns, Functions, and Algebra



Activity: Balance Those Blocks!

Format: Small Group

Objective: Participants will be able to use blocks to balance pictorial equations.

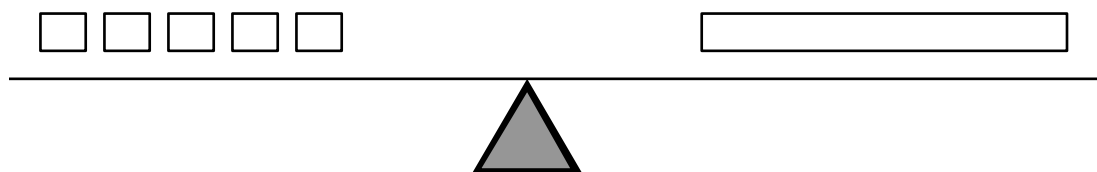
Related SOL: 2.26, 4.22, 5.21

Materials: Laminated balance scale, stationary physical scale, unit blocks, rectangular solids

Time Required: 15 minutes

Directions:

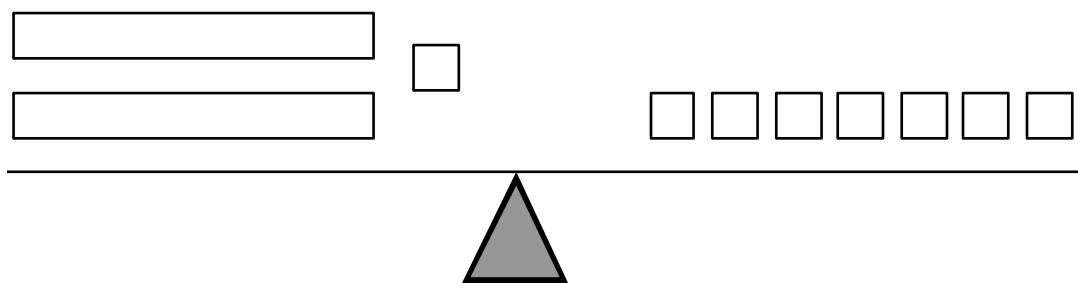
1. The teacher displays the equation on the physical scale in front on the class.



The teacher assists the participants in grasping the concept that both sides of the scale must have the same value for the scale to balance.

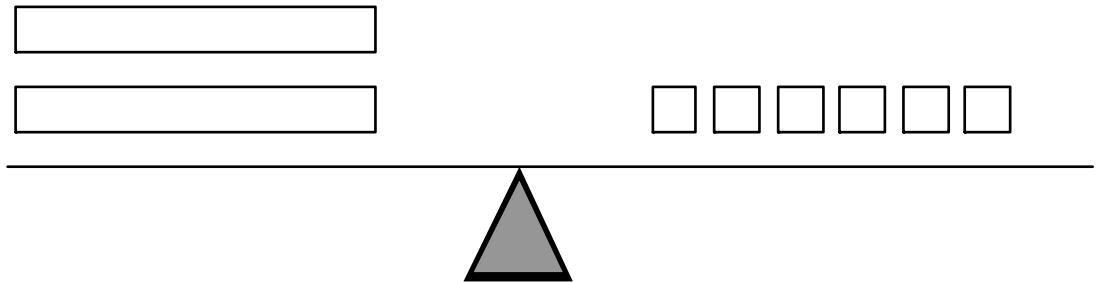
Participants begin to understand that the rectangular solid in the equation is valued at five in order to balance the five unit blocks .

2. The teacher then displays the equation $2x + 1 = 7$ on the physical scale.

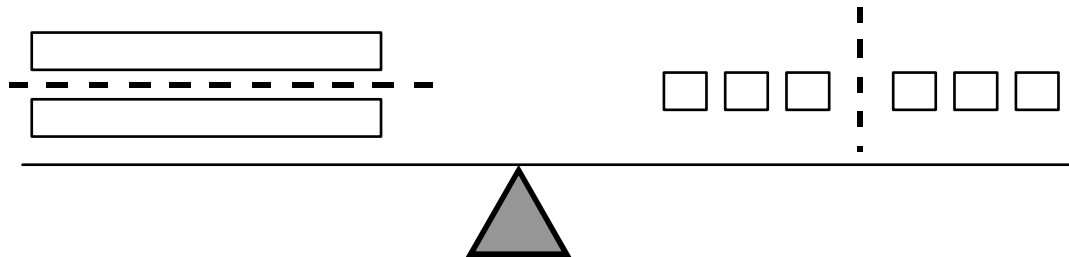


The teacher points out to the class that, in keeping the scale balanced, one unit block can be removed from each side of the balance scale.

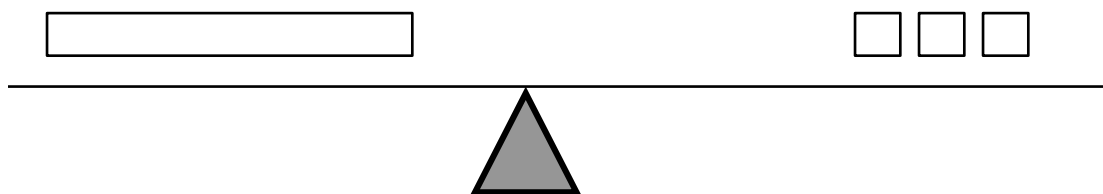
Patterns, Functions, and Algebra



The teacher assists the class in determining that the balance scale has two groups of blocks on each side. In order to successfully solve the equation, however, only one variable is needed. Thus, the teacher models for the class as she divides each side by two.



Participants again recognize that in order for the scale to balance the rectangular solid must be valued at three.



- Assign student partners to work together on their laminated balance scale mats to solve the equation: $3x + 1 = 13$ and $x + 4 = 2x + 3$.

Assess student understanding.

Patterns, Functions, and Algebra



Activity: Coat Hanger Balances

Format: Individuals

Objective: Participants will use their knowledge and understanding of the concepts of balance and equality to create their own coat hanger balance. These balances are foundation knowledge to the concept of equality found in algebraic thinking.

Related SOL: 2.9, 5.21

Materials: One coat hanger per participant (ask participants to supply their own), Shape pattern Activity Sheets printed on various colored cover stock (e.g., triangles on yellow, squares on blue, rectangles on green, etc.), yarn or string, tape, scissors

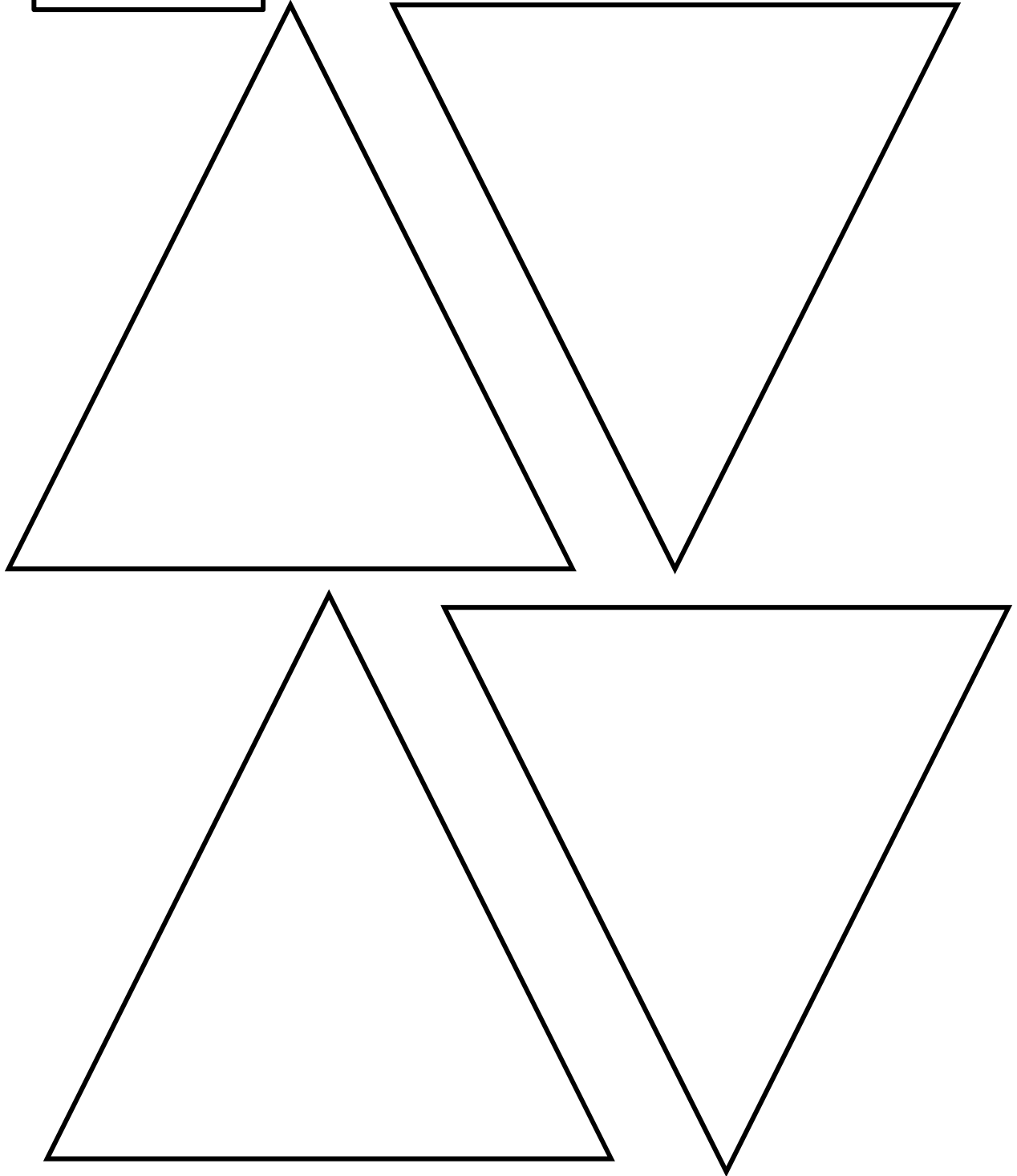
Time Required: 25 Minutes

Directions:

1. Participants are asked to create their own coat hanger balance using a variety of shapes where each shape stands for a number value or “weight.” Each shape should have a different value, just as each variable in an equation has a different value. The total value can be taped to the neck of the hanger.
2. Participants should exchange their balances with others and solve their balance problem, checking to see whether their solutions match. In cases where they do not match, participants should redo their problems.
3. Participants should pay attention to the following rules:
 - The right and left sides of the coat hanger must balance;
 - Each shape has a unique and consistent weight within the balance, and no shape weighs zero;
 - Clues may be attached at the neck of the hanger and should be checked to ensure that the weights are properly distributed;
 - Weights can be positive whole numbers, fractions or decimals; depending on the grade level taught by the participant;
 - A shape hanging directly below the fulcrum (center) does not affect the balance between the left or right arms of the balance;
 - Size of the shapes has no relation to the weight;
 - These are problems in balancing numbers and do not take into consideration distances from the fulcrum or any other principles of physical science.

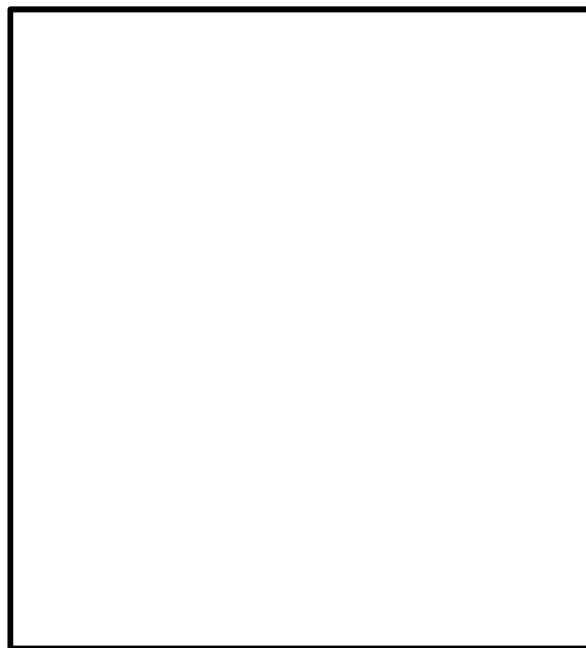
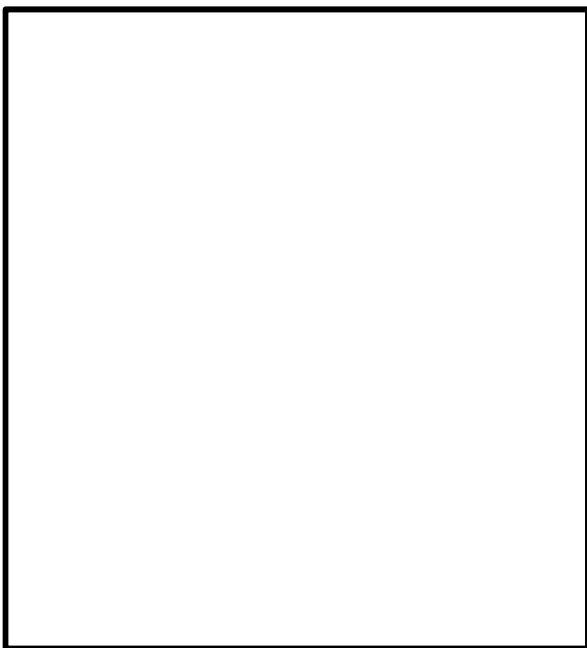
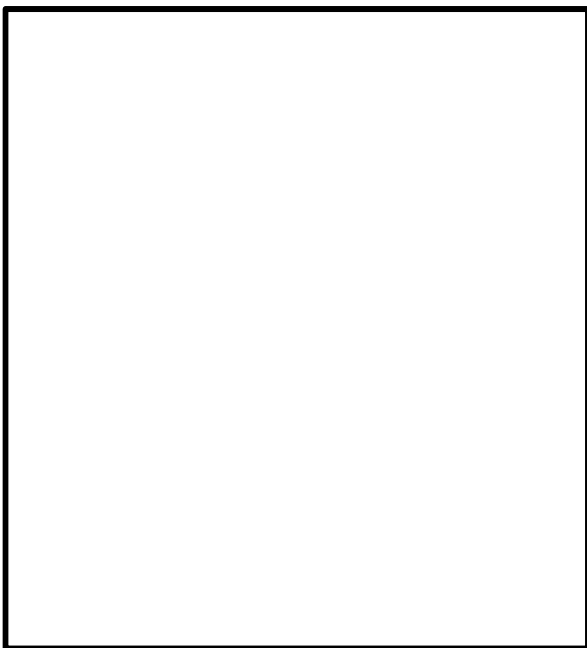


Triangles



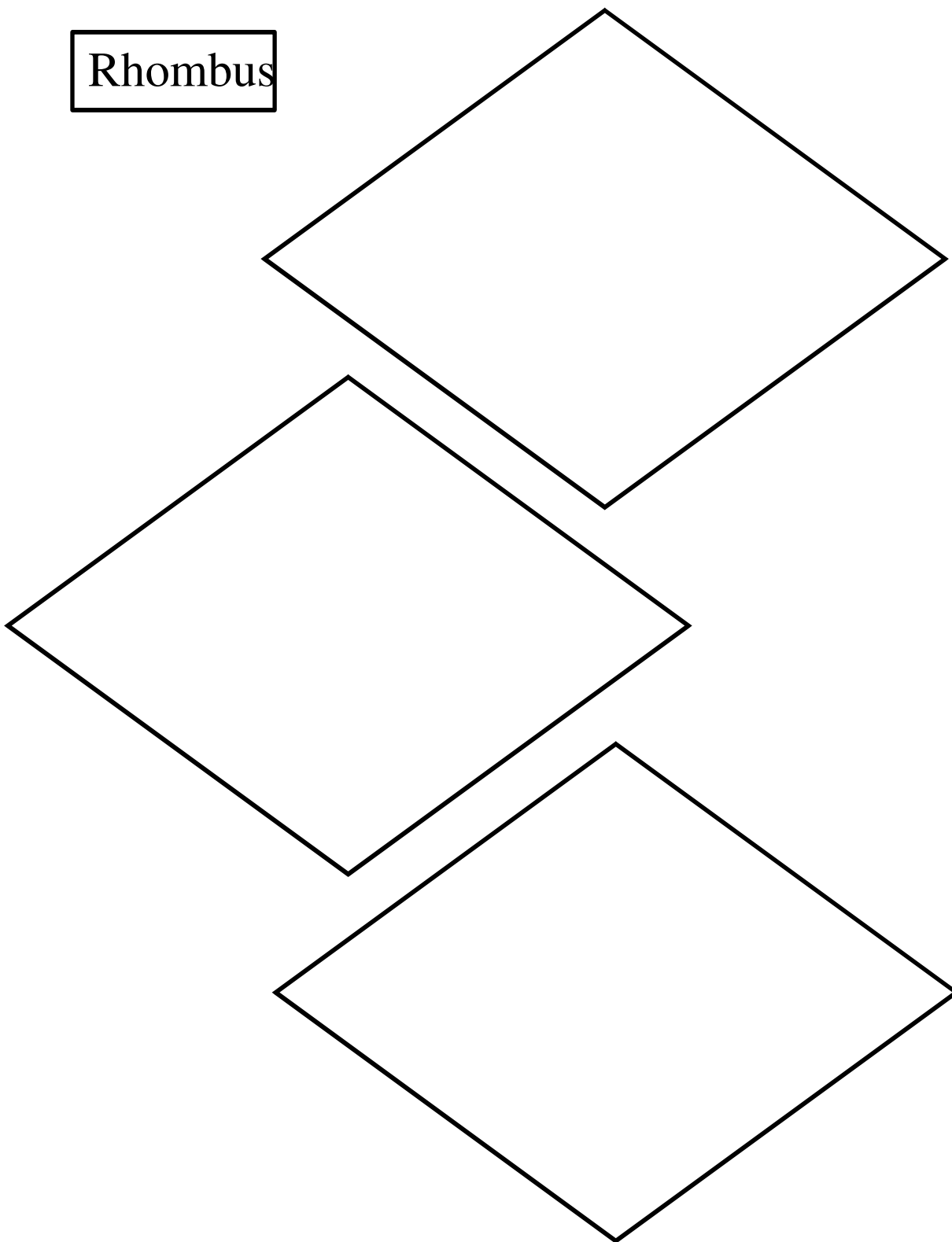


Squares





Rhombus





Hexagon

